IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of

NAKAMURA et al.

Atty. Ref.: 160-356

Serial No. 09/809,038

Group: 2814

Filed: March 16, 2001

Examiner: TBA

#7 IDS 10-16-01 R. Stokes

For: NITRIDE SEMICONDUCTOR LIGHT-EMITTING DEVICE

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October 11, 2001

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

INFORMATION DISCLOSURE STATEMENT

As suggested by 37 C.F.R. 1.97, the undersigned attorney brings to the attention of the United States Patent and Trademark Office the references listed on the attached form PTO-1449, a copy of each of which is enclosed. This is not to be construed as a representation that a search has been made or that no better prior art exists, or that a reference is relevant merely because cited.

The Examiner is requested to initial the attached form PTO-1449 and to return a copy of the initialed document to the undersigned as an indication that the attached references have been considered and made of record.

The undersigned attorney of record hereby certifies under 37 C.F.R. §1.97(e) that Japanese references No. 5-291618, 6-177243, 6-21511, 6-164055, 6-268257, 7-15041, 7-249795, and 9-36424 were cited in a communication from a foreign patent office in a counterpart application not more than three (3) months prior to the filing of this

Information Disclosure Statement. A copy of the July 17, 2001 office action, together with a translation of same is enclosed herewith.

The remainder of the references were cited in parent application Serial No. 09/370,170, of which this application is a divisional.

Respectfully submitted,

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English translation: not attached because it is not readily available
Concise Explanation of Pertinency: attached

Document No.: 62-1290, published January 7, 1987
Country: Japan
Copy of reference: attached
Language: non-English
English translation: not attached because it is not readily available
Concise Explanation of Pertinency: attached

Document No.: 1-264275 , published October 20, 1989
Country: Japan
Copy of reference: attached
Language: non-English
English translation: not attached because it is not readily available
Concise Explanation of Pertinency: attached

Document No.: 7-202325, published August 4, 1995
Country: Japan
Copy of reference: attached
Language: non-English
English translation: not attached because it is not readily available
Concise Explanation of Pertinency: attached

Sheet 1 of 1

INFORMATION DISCLOSURE CITATION

(Use several sheets if necessary)

ATTY. DOCKET NO.	SERIAL NO.
160-356	09/809,038
APPLICANT	
NAKAMURA et al.	
FILING DATE	**GROUP**
March 16, 2001	2814

U.S. PATENT DOCUMENTS

*EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
NBL		6,215,133	04/2001	NAKAMURA et al.	257	96	
		6,078,063	06/2000	NAKAMURA et al.	257	96	
		5,880,486	03/1999	NAKAMURA et al.	257	96	
		5,747,832	05/1998	NAKAMURA et al.	257	103	
		5,578,839	11/1996	NAKAMURA et al.	257	96	

FOREIGN PATENT DOCUMENTS

		DOCUMENT	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (including Author, Title, Date, Pertinent pages, etc.)

*Examiner		Date Considered 3/25/03

Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to application.

Form PTO-FB-A820 (Also PTO-1449)

Explanation of Relevancy

(1) Document A (Published Patent Application No. 6-268259)

Document A only discloses a gallium nitride based compound semiconductor light-emitting device having a structure of n-layer/n-type GaAlN clad layer/InGaN active layer/p-type GaAlN clad layer (thickness: 10 angstrom - 0.2 μ m)/p-type GaN contact layer.

In short, Document A neither discloses nor suggests the present invention.

(2) Document B (Published Patent Application No. 6-283825)

Document B deals with a problem intrinsic to a gallium nitride based compound semiconductor laser diode having a Si-doped n-type GaN active layer (or n-type $Al_{1-Y}Ga_YN$ active layer doped with at least an n-type impurity). More specifically, the problem is that Mg is diffused from a Mg-doped AlGaN layer to the Si-doped n-type GaN active layer, with the result that laser oscillation is not obtained or the threshold current increases. In summary, Document B cannot be applied to a nitride semiconductor light-emitting device having an active layer of a quantum well structure containing indium. Such an application is not suggested, either.

(3) Document C (Published Patent Application No. 4-68579)

Document C relates to a technique of lattice-matching ZnO and indium/gallium nitride by forming a ZnSO layer (whose composition is varied) on a ZnS substrate and forming a ZnO layer thereon, and further forming an indium/gallium nitride layer thereon.

Document C discloses:

in FIGS. 1 and 2, a device structure of n-type ZnO layer/n-type GaN light-emitting layer/p-type GaN layer,

in FIG. 3, a device structure of n-type ZnO layer/n-type GaInN light emitting layer/p-type GaN layer,

in FIG. 4, a device structure of n-type ZnO layer/n-type GaN light-emitting layer/p-type GaInN layer,

in FIG. 5, a device structure of n-type ZnO layer/n-type GaInN layer/n-type GaN-GaInN superlattice layer/p-type GaN layer, and

in FIG. 6, a device structure of n-type ZnO layer/n-type GaInN buffer layer/n-type GaN light-emitting layer/p-type GaN layer.

However, all of these light-emitting devices are not nitride semiconductor light-emitting devices since they inevitably have a ZnO layer as an n-type layer. In addition, even in the structure (shown in FIG. 5), which is the only one having two nitride semiconductor layers at both ends of the superlattice layer, an n-type GaInN layer does not act as a clad layer. More specifically, in the structure of FIG. 5, the n-type GaInN layer has the same composition as a GaInN superlattice layer. This means that both layers have the same band gap. Therefore, the n-type GaInN layer does not serve as a clad layer but the n-type Zno layer serves as the clad layer.

In short, the device disclosed in Document C differs from a nitride semiconductor light-emitting device. In addition, Document C neither discloses nor suggests the present invention.

(4) Document D (Published Patent Application No. 5-335622)

Document D discloses a light-emitting device having a $Ga_{1-x-y}In_xAl_yN$ layer ($0 \leqq x \leqq 1$, $0 \leqq y \leqq 1$) whose composition is gradually varied from the side of the layer close to the substrate and a light-emitting layer which is formed of an n-type layer and p-type layer or i-type layer consisting of $Ga_{1-a-b}In_aAl_bN$ ($0 \leqq a \leqq 1$, $0 \leqq b \leqq 1$) in combination. Document D shows only one example of a light-emitting layer having a quantum well

structure in FIG. 6. The structure is: n-$Ga_{1-a-b}In_aN$ ($0 \leqq a \leqq 1$)/quantum well structure/p-$Ga_{1-a-b}In_aN$ ($0 \leqq a \leqq 1$). There is no explanation other than this.

In brief, Document D neither discloses nor suggests the present invention.

(5) Document E (Published Patent Application No. 60-97684)

Document E only discloses an AlGaAs/GaAs-based semiconductor light-emitting device.

Document E is not relevant to a technique for a nitride semiconductor light-emitting device having an active layer of a quantum-well structure including an indium-containing nitride semiconductor, at all.

(6) Document F (Published Patent Application No. 62-1290)

Document F only discloses an AlGaAs/GaAs-based semiconductor light-emitting device.

Document F is entirely irrelevant to a technique for a nitride semiconductor light-emitting device having an active layer of a quantum well structure including an indium-containing nitride semiconductor.

(7) Document G (Published Patent Application No. 1-264275)

Document G only discloses an AlGaAs/GaAs-based semiconductor light-emitting device.

Document G is entirely irrelevant to a technique for a nitride semiconductor light-emitting device having an active layer of a quantum well structure including an indium-containing nitride semiconductor.

(8) Document H (Published Patent Application No. 7-202325)

Document H is concerned with a laser diode formed of a gallium nitride-based compound semiconductor of a double-hetero junction structure having an active layer sandwiched by layers having a larger band gap than the active layer. The nitride semiconductor material forming the

double hetero junction structure is not particularly limited. As an example of an active layer, only a structure of an active layer formed of GaN is shown in FIG. 1. Furthermore, an active layer of a quantum well structure is not shown, at all.

More specifically, Document H is entirely irreverent to the technique of a nitride semiconductor light-emitting device having an active layer of a quantum well structure including an indium-containing nitride semiconductor. Needless to say, Document H neither discloses nor suggests the present invention.